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S&T CENTER

Vol. 2, No. 17
22 December 1987

# Science and Technology Perspectives

*DEVELOPMENTS*

**Biotechnology Data Base**

(Japan/FRG) The German BIJANCA (Biochemistry in Japan— National and Corporate Activities) data base, which provides information on Japanese biotechnology R&D, began operation on 1 September. Hosted by the FRG's Society for Biotechnological Research (GBF), BIJANCA tracks research trends and joint ventures among Japanese firms, institutes, and laboratories. It also offers specialized searches of information on Japanese biotechnology R&D available in Western data bases, queries of the Japanese JICST (Japan Information Center of Science and Technology) data base, reports on Japanese biotechnology conferences, analyses of the Japanese biotechnology trade press, and collections of company reports and brochures. Japanese experts recently evaluated all of BIJANCA's information sources in a report published in the FRG periodical NATURWISSENSCHAFTEN (Natural Sciences) (No. 74, 1987). (For previous reporting on BIJANCA, see PERSPECTIVES Vol. 2 No. 6, p. 2). (Braunschweig BIOTECHNOLOGIE Sep 87) Eva L. X6339

. . . . .*Continued on Page 1*

*PREVIEW*



FBIS is introducing a new publication in the JPRS Science & Technology series: FOREIGN DATA BASES.

*FEATURED IN THIS ISSUE:*

*Energy & Fuel Technology*



The French are designing a nuclear generator for use in civilian and military spacecraft of the early 21st century.



The French are manufacturing and testing the high-energy propellant Nitralane for eventual use in their M5 ballistic missile.

***REPORTS***



PERSPECTIVES selections are based solely on foreign press, books and journals, or radio and television broadcasts. Some of the materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Managing Editor (Craig M. [redacted]) or to individuals at the numbers listed with items.

STAT

*Correction*: In Vol. 2, No. 16, the last portion of paragraph 4 on page 4 should read: The complex consists of an automated chemical laboratory, a disarming chamber, a neutralization reactor, an automatic feed apparatus for supplying degassed solutions, a combustion unit, a compressor, an automatic loader, a prime mover, and an electric power plant. It has a chemical detecting device which controls the environmental safety of the process. The bomb was destroyed in about 1.5 hours without incident.

# *DEVELOPMENTS*

*DEVELOPMENTS highlights worldwide S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided. Please prefix all extensions with a 3.*

**Aerodynamics**

(FRG/France) MBB (Messerschmitt-Boelkow-Blohm), the DFVLR (German Air and Space Research and Test Facility), and Airbus Industrie are conducting wind tunnel tests of aircraft (not further identified) coated with a new material that has been shown to reduce skin friction by 8 percent and drag by 2 percent. The new material is a lightweight, very thin plastic film on which microscopic, sharp-edged grooves called riblets are formed. Measuring 0.05 millimeters in height and width, the riblets produce the improved aerodynamics by their shape and alignment. With a total thickness of 0.07 millimeters including riblets, the film is expected to add only 150 kilograms to total aircraft weight of an Airbus A-320 when laminated to the fuselage, wings, and empennage. Airbus Industrie is flying its A310-300 demonstrator aircraft using riblets on the side of one of the engine nacelles to measure their effect. (Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT 28 Sep 87; Paris AIR & COSMOS 3 Oct 87, 10 Oct 87) Eva L. X6339

**Military Communications Satellite**

(Italy) The Italian Defense Ministry is developing the SICRAL (Italian Classified Communications and Warning Satellite) for planned launch in 1993-94 aboard a space shuttle or an Ariane 4. The SICRAL, which may use the same basic structure and solar panels as the Italsat telecommunications satellite, will be equipped with a UHF transponder providing coverage from geostationary orbit; a 7-8 GHz-band transponder with a multibeam parabolic antenna for Italian military and NATO communications; an 11-14 GHz-band transponder with a parabolic antenna for civil defense; and a 20-44 GHz-band transponder for Mediterranean maritime communications. (Rome AVIAZIONE Jun 87)* Jane B. X6286

**Superconductivity**

(GDR) The Academy of Sciences' Central Institute for Solid State Physics in Dresden has developed a material (not further identified) with a transition temperature of 91K and a critical temperature of 83K. Samples of the material reportedly exhibited diamagnetism at 83K. Other GDR institutes conducting superconductivity research include Humboldt University in Berlin, Dresden Technical University, and the Central Institute for Nuclear Research in Rossendorf, all of which have reportedly developed materials (not further identified) with transition temperatures between 88K and 95K. (Berlin WISSENSCHAFT UND FORTSCHRITT Sep 87) Eva L. X6339

(Japan) Furukawa Electric, the Tokyo Power Company, the Hokkaido Power Company, and the Tohoku Power Company have jointly developed a superconducting wire coil. A superconducting powder, composed of yttrium, barium, copper oxide, was pressurized and then extruded into a 1-millimeter diameter wire; the "winding and reacting" method was used to form the wire into a coil. The 1.5-meter long wire was wound 20 times around a 21.4 millimeter core and tested using a liquid nitride coolant (at 77K) to produce a magnetic field of 20 gauss, equivalent to a critical current density of 1,330 amps per square centimeter. The test was repeated successfully a month later. (Tokyo ASAHI SHIMBUN 30 Oct 87) Junko A. X6335

***PREVIEW***

## NEW JPRS SCIENCE & TECHNOLOGY REPORT: FOREIGN DATA BASES

FBIS is introducing a new publication in the JPRS Science & Technology series: FOREIGN DATA BASES. This report will serve as a vehicle for disseminating information on science and technology from foreign commercial and private data bases. It will be published approximately once a month.

A key objective of the report is to establish a dialogue with readers concerning S&T requirements that may be met by information from data bases. Each issue will contain a tear-out sheet which will allow the reader to request:

—*Fuller processing of reports cited in data base abstracts*

—*Data base searches tailored to specific reader interests*

—*Background information on data bases covered by FBIS*

The scope of FOREIGN DATA BASES will be worldwide, with an initial emphasis on technological developments in Europe (including Bloc countries) and Japan. As with other reports in the JPRS Science & Technology series, FOREIGN DATA BASES will offer multidisciplinary reporting, regularly covering fields such as aerospace, biotechnology, microelectronics, telecommunications, and other critical areas. In addition, special issues of the report will focus on a single topic, as does the inaugural issue, which describes the 58 new R&D projects approved at the recent Eureka (European Research Coordinating Agency) Ministerial Conference in Madrid. This first issue will include information on project partners, resource allocations, and project duration. Technologies addressed are *automation, automotive R&D, lasers/optics, microelectronics, telecommunications, and transportation.*

Readers who currently receive the EUROPE/LATIN AMERICA and JAPAN S&T reports will automatically be placed on distribution for FOREIGN DATA BASES. Nonsubscribers interested in receiving this new report should contact FBIS Liaison & Requirements Branch at 733-5846. The FBIS Science & Technology Center welcomes reader comments and questions as well as suggested topics for future coverage.

# FRANCE: NUCLEAR GENERATOR FOR SPACECRAFT

*Key Points: The National Center for Space Studies (CNES), the Atomic Energy Commission (CEA), and the French military are studying high-capacity nuclear generators for spacecraft in the 21st century. French experts, who anticipate that the first civilian unit will be ready for launch by 2010, project that an initial military use of the generator will be to power a radar reconnaissance satellite, according to REVUE GENERALE NUCLEAIRE (May-Jun 87).*

With a potential capacity to generate large amounts of energy and operate without maintenance for extended periods, the nuclear generator as a power source for spacecraft has been under study by France's CEA for some 20 years. In 1982, the CNES and CEA began a joint study (completed in 1985) anticipating that Ariane V would give France the capability to launch nuclear-powered spacecraft after 1995. In addition, French military experts reportedly are now participating in a study of versions that would be adapted to military needs after the year 2000.

A second-phase study that will conclude in 1989 is focusing on the development of high-temperature materials for use in a nuclear generator. The third phase is expected to concentrate on production and testing of generator components and subsystems. Anticipated launch of the first generator-powered spacecraft is between 2005 and 2010. The first military mission reportedly might be a radar reconnaissance satellite, an advanced and costly system appropriate for pan-European development and use. Although the project is presently funded only by CNES and CEA, the sponsors hope to attract European participation.

Studies of various generator designs are focusing on power supply applications for:

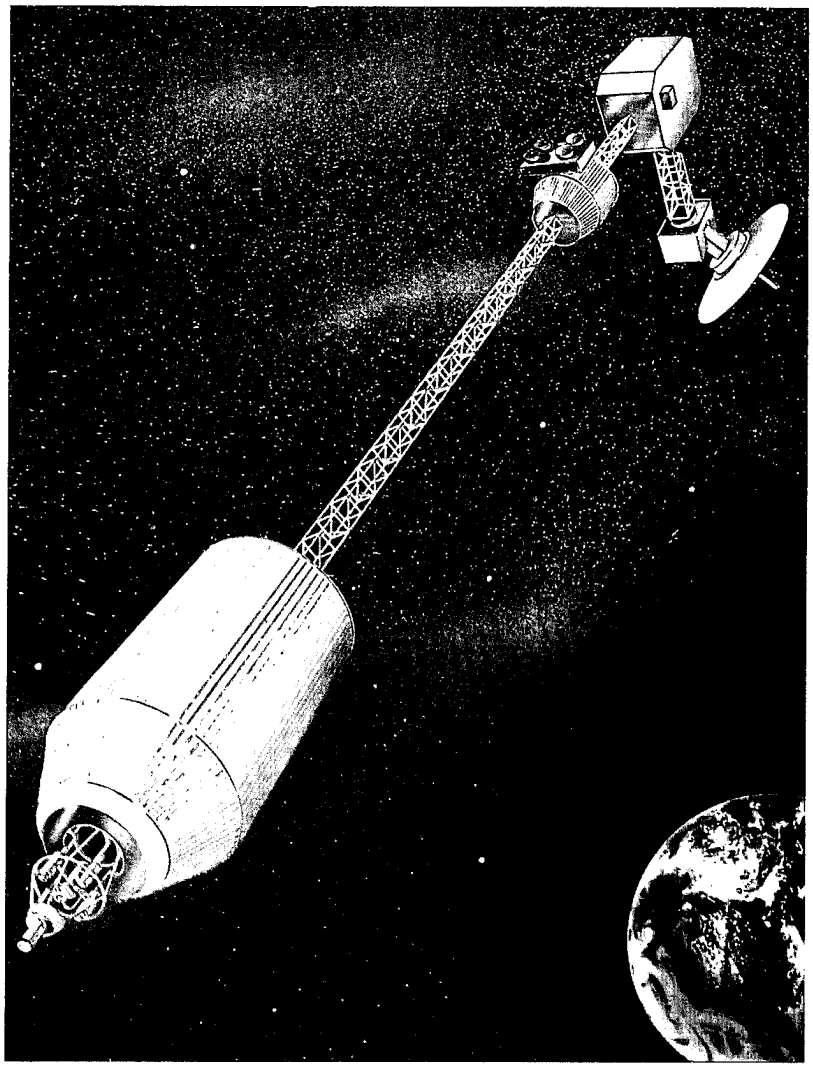
—The European Space Station

—Large civilian and military orbital radars

—Infrared sensors with cooled optics

—Unmanned deep-space probes

The ERATO (Nuclear Electro-Tug for Interorbital Transfer) generator (see artist's conception below) is being used as a reference design. The space tug configuration was selected because it has the greatest number of different features needed in a wide variety of missions. ERATO has enabled designers to evaluate technologies, select technical options, define system dimensions, and estimate development costs and schedules. Technical specifications for ERATO include a power range of 50-400 kW (200 kW nominal), a weight of approximately 7 metric tons, a primary radiating surface limited to 140m$^2$ carrying about 300 heat pipes, a 7-year life span without maintenance, and a shield to protect sensitive materials and payload from reactor radiation. The ERATO system's overall length is 17 meters with a diameter of 4.6 meters. The fast neutron reactor core is a cylinder 320 millimeters in diameter and height and will use highly enriched uranium rods of $UO_2$ or UN, cooled with circulating liquid lithium. Four 100 kW turbo-engines, each composed of a gas turbine, a compressor, and a closed-circuit Brayton cycle heat capture-exchange unit, make up the energy conversion system. A management system will handle command and control of the reactor, regulate the energy conversion system, and monitor the various subsystems. Only missions with orbits greater than 800 kilometers are being considered at present.



Based on initial findings, the study group concluded that the mass of a nuclear generator would be one-half to one-third that of a solar generator of the same capacity. The size would be about one-twentieth that of the solar generator, providing major fuel economy in station keeping for large satellites in low orbit (such as space stations). Recurrent costs are expected to be approximately one-tenth those of solar generators of the same wattage; development costs should be approximately equal to the purchase price of a 200 kW solar generator and should be recovered as soon as the first generator is put into service. Resistance to external effects will make them very useful for military applications. Nuclear safety measures for launch and generator activation are under study and will be fully ground-tested.

Although the study group believes technical and safety problems can be solved, the high-temperature technology involved will require an extended development phase (15-20 years). Laboratory studies of critical technologies have begun. A molybdenum-rhenium alloy is planned for fuel cladding, the core vessel, and primary circuit, and the tantalum alloy ASTAR 811 C is under consideration for the turbine. While much data are available on the properties of $UO_2$, its reaction with liquid lithium in case

of rupture of the cladding presents a design problem. The French are looking at the use of UN as a potential solution, but a complete fuel qualification program would be required. In addition, a number of non-standard components must be developed, among the most critical being the lithium-gas intermediate exchanger; high-performance electromagnetic pumps for the lithium; long-lived turbines, compressors, and alternators that must function for seven years without maintenance; and gas heat-pipe exchangers (evaporators).

Martha W. X6285

# FRANCE: HIGH-ENERGY PROPELLANT

*Key Points: France's SEP (European Propellant Company) and SNPE (National Solid Fuel and Explosives Company) have announced a successful bench firing of Nitralane, a very high energy, solid propellant intended for the upper stages of the next-generation M5 submarine-launched ballistic missile (SLBM). Tests will begin after 1991 with the missile slated for service by the year 2000, according to Defense Minister Andre Giraud. AIR & COSMOS (Jun/Sep/Oct 87) reported that the French have been conducting Nitralane R&D since 1980 and, in 1982, established a test and production facility at St.-Jean-d'Illac near Bordeaux.*

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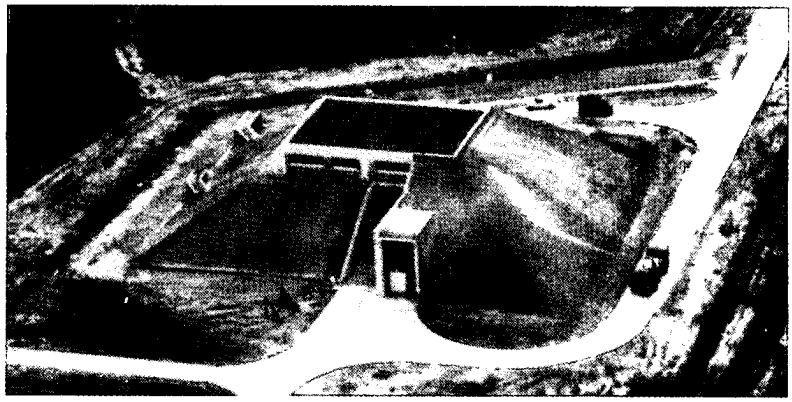
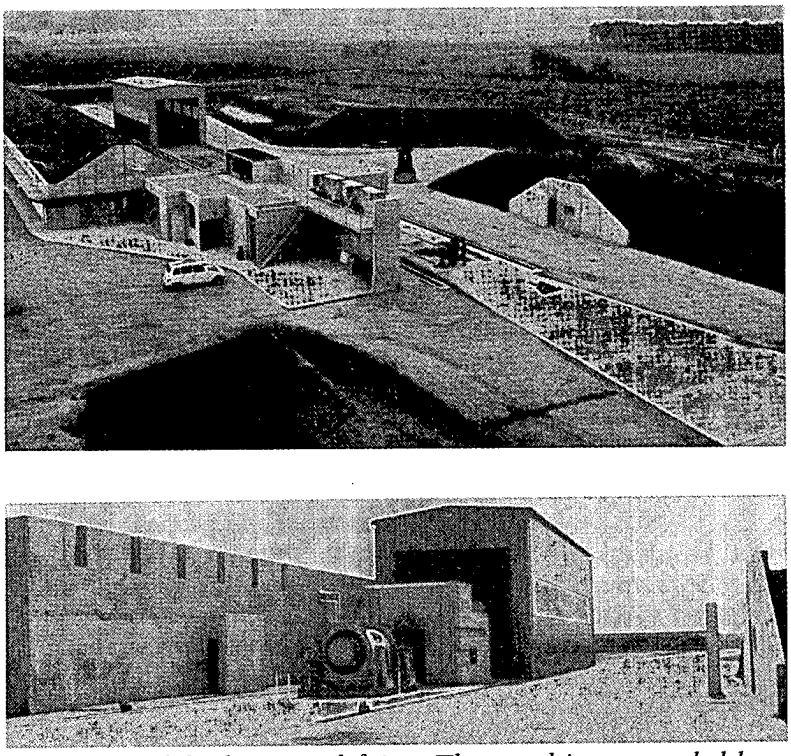
France reportedly is the only Western country besides the United States to have mastered the very difficult technology for manufacturing and handling Nitralane, the most powerful solid propellant in use today. Nitralane is one of the "new breed" of composite double-base solid propellants that use a nitrocellulose-nitroglycerine binder as a matrix for the aluminum fuel and ammonium perchlorate oxidizer with HMX (cyclotetramethylene tetranitramine) as an additive. It is superior to Butalane X with HMX (which gives a specific impulse of 267 seconds) used in the M4 SLBM. Nitramite, an analogous propellant lacking aluminum, has been used for several years in French missiles (AS15TT, Exocet AM39, SM39, and MM40 anti-ship and Shahine and Roland 3 anti-aircraft missiles.)

The Fr24-million, 2700-hectare Nitralane production facility at St.-Jean-d'Illac was officially unveiled this year after the successful firing on 8 July of a 2.5-metric-ton test block. Although the facility is designed to manufacture and test up to 10 metric tons of high-energy propellant, the exploratory development program for Nitralane is currently limited to 2.5 metric tons. After the test phase is satisfactorily completed, larger Nitralane motors will be built, anticipating those for the M5.



*Nitralane casting building*

Approximately 15 technicians in a computerized command post manage all phases of preparation, mixing, casting, curing, and checking of the Nitralane. Nitroglycerine (manufactured at the site through nitration of glycerine with sulfonic acid), the constituent portions of ammonium perchlorate and aluminum (also prepared at the site), and HMX (manufactured at Sorgues) are combined in a 2.5-metric-ton-capacity mixer. The propellant mix is then poured under vacuum into the motor casing which is held in a casting pit. After curing, the mandrel (defining the grain configuration of the central channel of the propellant) is withdrawn from the propellant. The motor is inspected by televised radiography before being sent to the test stand (designated EB1) which permits horizontal firing and thrust measurement for up to 25 metric tons of conventional propellant (non-detonating) or up to 10 metric tons of Nitralane propellant. A vertical test stand (nozzle upwards) for testing larger motors will be installed next year at a cost of about Fr30 million.



*EB1 test stand for horizontal firing. The stand is surrounded by a revetment and a wall for personnel protection.*

SEP also reports that a motor to be used for the M5 was successfully bench tested at the CAEPE (Engine and Missile Assembly and Test Center) altitude simulator at St. Medard. The test included extension of the bell-shaped nozzle on the exhaust. The aft assembly has a flexible carbon fiber composite thrust block, a thermostructural movable support made of SEPCARBINOX (a ceramic-matrix composite), a bell-shaped throat of SEPCARB 4-D, and two telescoping rings. The graphite-epoxy motor case has a full ring flange mounting and an internal light-weight rubber insulator with a specific gravity of less than 1.

Martha W. X6285

# WEST EUROPE: ADVANCES IN FACTORY AUTOMATION

*Key Points: West European factory automation experts have developed specialized sensors and structural designs to build robots with a high degree of autonomy, mobility, and strength. Notable achievements include a wireless, mobile robot guided by ultrasonic and optoelectronic position sensors, and a "seeing" robot capable of lifting 40 kg, according to August-October reporting in the West German and French press.*

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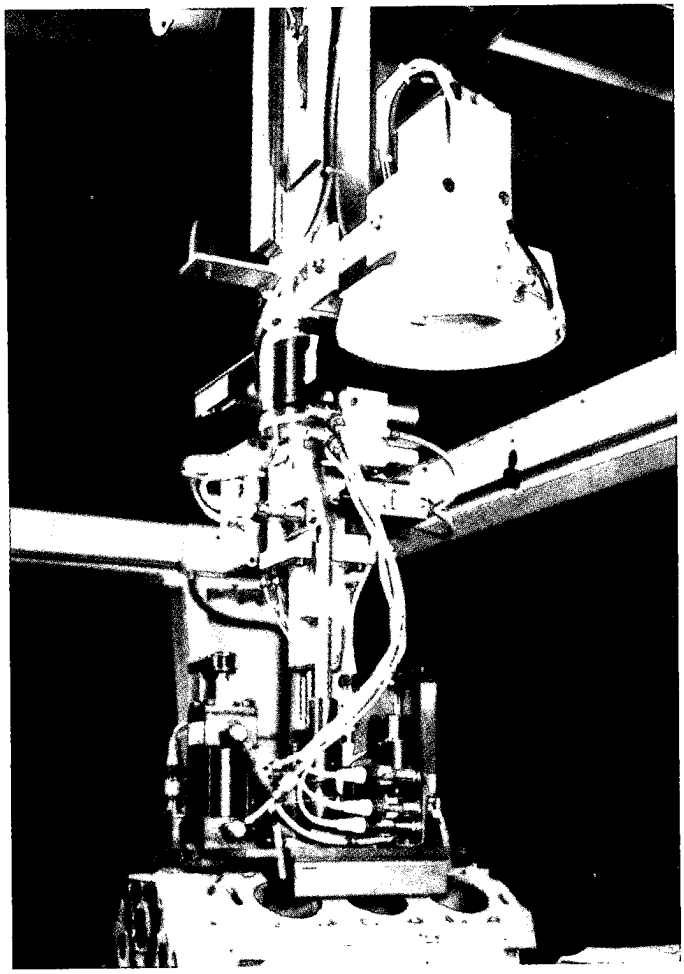
In an effort to design robots with a wide range of factory automation applications, West European nations have focused their R&D on position and image sensing systems that allow robots to perceive and react to their surroundings autonomously. In combination with special structural designs, the sensing systems improve robot mobility and lifting capacity, as shown by recent innovations at the Fraunhofer Institute and Duerr Company of the FRG, ASEA of Sweden, and Fiat of Italy.

Conventional mobile robots are wire-guided, traveling a fixed path on a cable system installed in a factory floor. Elimination of this system is the goal of the Fraunhofer Institute for Production Technology and Automation (IPA), which has developed the "Ipamar" prototype mobile robot. Featuring 13 ultrasonic and two optoelectronic sensors, Ipamar is wireless and moves on three wheels. The robot's directional mobility is based on a comparison of two sets of data stored in its onboard computer. A reference map of the factory floor is stored in the robot's computer. Information on changes in factory layout can be sent to the computer from a computer-aided design workstation via an infrared communications system. Onboard ultrasonic sensors then determine the robot's position based on the angles and length of the path it has traveled. The robot moves after comparing this position with the reference map.

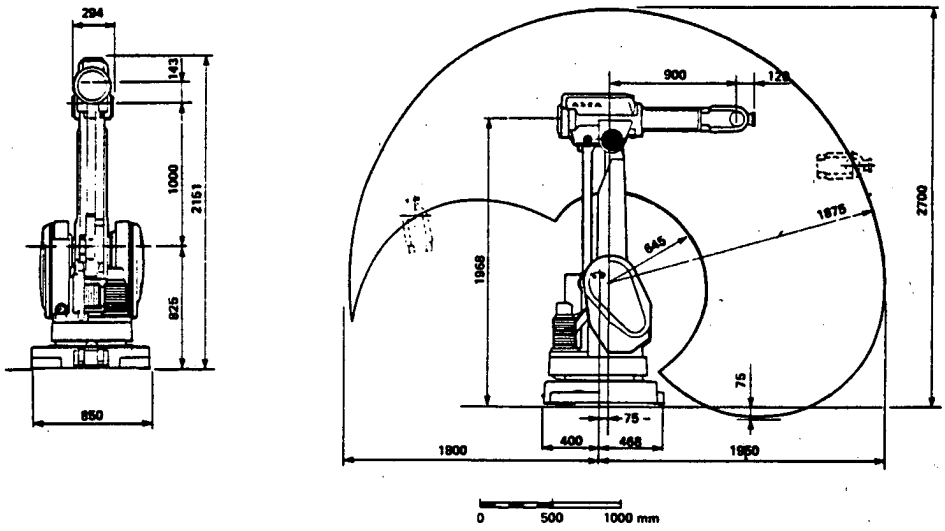
Designed to transfer 600 x 400-millimeter printed circuit board magazines among various stationary locations in a factory, Ipamar uses its optoelectronic sensors to precisely locate its position when approaching a transfer point. Equipped with eight ultrasonic sensors whose transducers have specially designed emission characteristics (not further described), Ipamar can anticipate and avoid collisions.

While Ipamar can reduce factory automation costs by eliminating expensive robot guidance equipment, the P-100 gantry robot developed by Duerr relieves workers of heavy lifting tasks. The key to the P-100 is a new image processing system which recognizes 128 shades of grey and which, combined with the strength afforded by the robot's gantry structure (the supporting frame), enables the robot to lift 40-kilogram cylinder blocks from a rack onto a conveyor belt at 18-second intervals. The difficulty of recognizing the position of a cylinder block with slanted cylinder bores is overcome by the P-100's camera system, which resolves the image of the cylinder block into a grid of 256 x 256 picture elements (pixels) and assigns each pixel one of the 128 shades of grey. Comparison of the processed image with an image stored in the robot's computer produces the exact location of the cylinder block. The robot then positions its arm above the cylinder block and descends toward it. A limit switch is triggered to halt the descent once the arm reaches and grips the cylinder block. The P-100 has been used in a pilot program at an unspecified auto factory since late 1986.



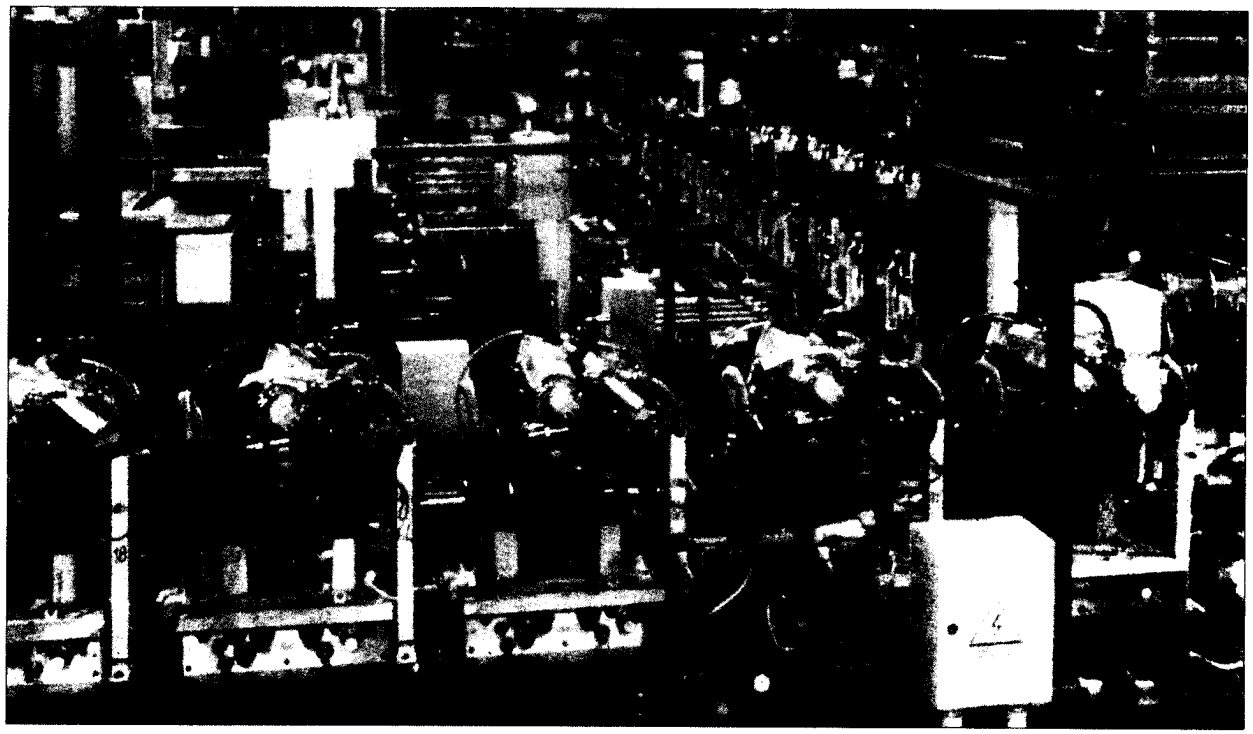
*Special lighting provides sufficient brightness for the camera attached to the gripper of the P-100.*

While sophisticated image processing and strength distinguish the P-100, its movement possibilities are limited. In contrast, ASEA's (Sweden) IRB 3000 combines a 30-kilogram lifting capability with a high degree of flexibility. Having six degrees of freedom (the axes of motion on which the robot components rotate) with axes that can rotate as much as ± 250° , the IRB 3000 features integration of all its cables and wires inside the robot arm. The resulting maneuverability makes the IRB suited not only for materials handling tasks but also for spot welding and laser or water-jet cutting in a workspace with a radius of 1.95 meters and a height of 2.7 meters.




*The dimensions of the IRB 3000 and its workspace.*

Ipamar, the P-100, and the IRB 3000 represent steps toward a West European goal of integrating individual robots into a fully automated assembly system. Fiat's engine production plant at Termoli is a recent example of robotics applied in integrated factory automation. The plant is a computer-controlled, fully automated engine assembly facility. In a 52,000m² hall, 150 robots and materials handling devices assemble one FIRE (fully integrated robotized engine) every 20 seconds.



*View of the FIRE production plant in Termoli.*

Eva L. X6339

# USSR: CRITICISM OF NATIONAL SPACE PROGRAM

*Key Points: In spite of recent successes, harsh criticism has been directed at the management of the Soviet space program. Some commentators now claim that space research has yielded no significant economic benefits, according to recent reporting in the Soviet press.*

The policy of glasnost has made itself felt in the traditionally sensitive area of the Soviet space program. A number of space scientists and officials used press appearances on the occasion of the 30th anniversary of the launch of Sputnik-1 to censure a lack of focus and direction in the management of space R&D, particularly in the area of materials processing. According to some commentators, the bureaucratization of space program management together with the lack of involvement of scientific organizations in applications for their research are the primary causes for the failure of space research to yield significant benefits to the national economy.

One clear purpose of the unprecedented wave of criticism is to provide support for the Gorbachev policy of economic restructuring (perestroyka) and, in particular, the move to make scientific organizations self-supporting units. A joint resolution of the CPSU Central Committee and the Council of Ministers, published in EKONOMICHESKAYA GAZETA (No. 42, Oct 87), orders a transfer of all scientific organizations to the system of self-financing and full-scale profit and loss accounting (khozraschet). The resolution applies to all scientific organizations, including those of the USSR Academy of Sciences. This new market economy approach is intended to compel R&D entities to take into account the needs of the enterprises and ministries for whom they will perform contract work and, thus, to involve them in the wider economic effects of their work. The consequences for failing to adapt to the new system are severe. The resolution specifies that a scientific organization will be disbanded if its work is consistently poor and if the organization is unable to find contractors for its services.

The changeover to the new system will be implemented gradually. A 2 October article in TRUD by a special correspondent at the Kaliningrad Flight Control Center provides one example of the new financial arrangement. The article criticizes the failure to efficiently utilize space photography for assessment of agricultural areas and crop conditions in spite of the many years spent in providing remote sensing data to the agricultural sector. However, starting in 1989 the Flight Control Center will require payment for performance of research and experiments aboard orbital stations. This, the correspondent claims, will improve the present situation in which work performed by cosmonauts is not utilized and valuable research programs are often bypassed because of insufficient access or less energetic advocacy on the part of their sponsors.

The 12-18 October issue of NEDELYA carries an interview with Lt. Gen. V. A. Shatalov, chief of the Gagarin Cosmonaut Training Center, in which he characterizes the general state of Soviet science as remote from practical needs and only weakly interacting with the national economy. Responding to a question as to whether he is satisfied with the economic return from manned space flights Shatalov criticizes a lack of effective direction and program guidance. He claims that in many cases there has been no follow-up to pursue promising results obtained in cosmonaut experiments. He suggests that time could be saved by employing reentry capsules to return research materials to earth during the course of long-duration missions. (Reentry capsules have been used in the past. For example, a capsule with 350 kilograms of research materials was returned from the Cosmos-1443 spacecraft while it was docked to the Salyut-7 station.) According to Shatalov, the current pace of development for orbital programs is so slow that some space-based manufacturing processes initially judged to be economically viable often turn out to be performable with ground-based equipment at comparable cost levels. In Shatalov's opinion, at the present pace, the creation of "the orbital shops and factories so often promised in the press" will not be achieved until after the year 2000.

A similar view was expressed by space scientist V. S. Avduyevskiy in an interview in LITERATURNAYA GAZETA (30 Sep). Avduyevskiy asserts that in spite of promising initial results from orbital materials processing, work has not yet begun on industrial production of materials in space. In his view, the range of experiments undertaken has been too broad and unfocused. Avduyevskiy suggests that efforts be concentrated on only those materials which are most promising for industry and that programs be developed to produce them in orbit in sufficient quantity.

The tone of some other recent commentators is significantly harsher and goes far beyond a mere endorsement of the new economic policies. In an interview in the 1 October issue of IZVESTIYA, Academy of Sciences member B. Ye. Chertok contrasts his experience in the early days of the Soviet space program with the situation which has now evolved. He characterizes the present management structure as an unwieldy bureaucracy that hobbles with floods of paperwork and "incompetent advice" the efforts of those who actually create space technology. Chertok asserts that if the developers of the Sputnik project had been burdened with the necessity of spending the months now required to obtain hundreds of concurring signatures and official stamps on various documents their program would have been seriously delayed. Chertok's criticism of the present managers goes beyond charges of bureaucratic incompetence and suggests actual malfeasance. He asserts that the new national policy of "restructuring" is urgently required to counter the regressive influence of "a bureaucratic apparatus which is essentially concerned only with the modernization of its own well-being."

Perhaps more significant, although stated less dramatically, are the comments of Lt. Gen. K. A. Kerimov, chairman of the State Commission for Flight Tests of Manned Space Complexes, published in the 4 October issue of KOMSOMOLSKAYA PRAVDA. The commission chaired by Kerimov exercises authority over spacecraft testing and acceptance, confirms cosmonaut crew selection, authorizes launches, and has operational approval over space mission programs. Kerimov has held this position since 1965, but it was only in interviews published a few months ago (BAKINSKIY RABOCHIY, 19 Aug; SOVETSKAYA ROSSIYA, 22 Aug) and hailed as examples of the new policy of glasnost that he was identified and the role of his state commission discussed. Responding to a question in the 4 October interview as to which problems facing Soviet cosmonautics he considers to be most serious and which organizational areas are most in need of restructuring, Kerimov first praises the quality and record of reliability of Soviet space hardware. "But," he continues, "there has as yet been very little of practical benefit to the national economy from space research—and there could have been far more." Kerimov claims that no clearly defined, long-term program for research aboard orbital complexes has been developed. Valuable research in materials, biotechnology, and remote sensing of natural resources has found no practical application because of the absence of a coherent policy. Institutes generate research requests at random, without coordination. Kerimov strongly favors the introduction of the system of profit and loss accounting in the space sector. In a clear endorsement of the efficiency of market forces he affirms that the economy itself is best able to regulate the system. In Kerimov's opinion, if the reforms are instituted correctly there would be no need for "the army of bureaucrats who only interfere with the work."

While the press assault on space program management would have been unthinkable in the pre-glasnost era, the present criticism stops short of naming specific organizations or individuals who have been at fault. The only instance of a specific recommendation occurs in the interview with Lt.-Gen. Shatalov when he suggests that economic results from space research might be speeded up by expanding the functions of the recently created national space organization Glavkosmos (see PERSPECTIVES, Vol. 1, No. 7 p. 4).

The prominent emphasis on failure to achieve results in the field of space materials processing may be interpreted as an implicit criticism of the USSR Academy of Sciences and the Academy's Institute of Space Research. The launch of the Mir space station in February of 1986 was hailed as marking the start of the transition from the research stage to large-scale materials production in orbit. At that time, coordination of all R&D in space materials was assigned to the Scientific-Technical Council for Problems of Space Materials Sciences, a body newly created by the Academy of Sciences. The Institute

of Space Research was named as the lead organization in this area. Failure to achieve rapid progress may be indicated by the recently announced schedule for launch of specialized modular additions to the Mir station. According to the French aerospace journal AIR & COSMOS (17 Oct), the Soviets have stated that the next two modules will be a biomedical module ("Medilab") to be launched around 1990 and a remote sensing module ("Priroda") in 1992. If this schedule is adhered to, a dedicated materials processing module will not be placed in orbit until the mid 1990s.

John C. X6324

*REPORTS*

*REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.*

## INTERNATIONAL CONFERENCE: SPACE COMMERCE 88

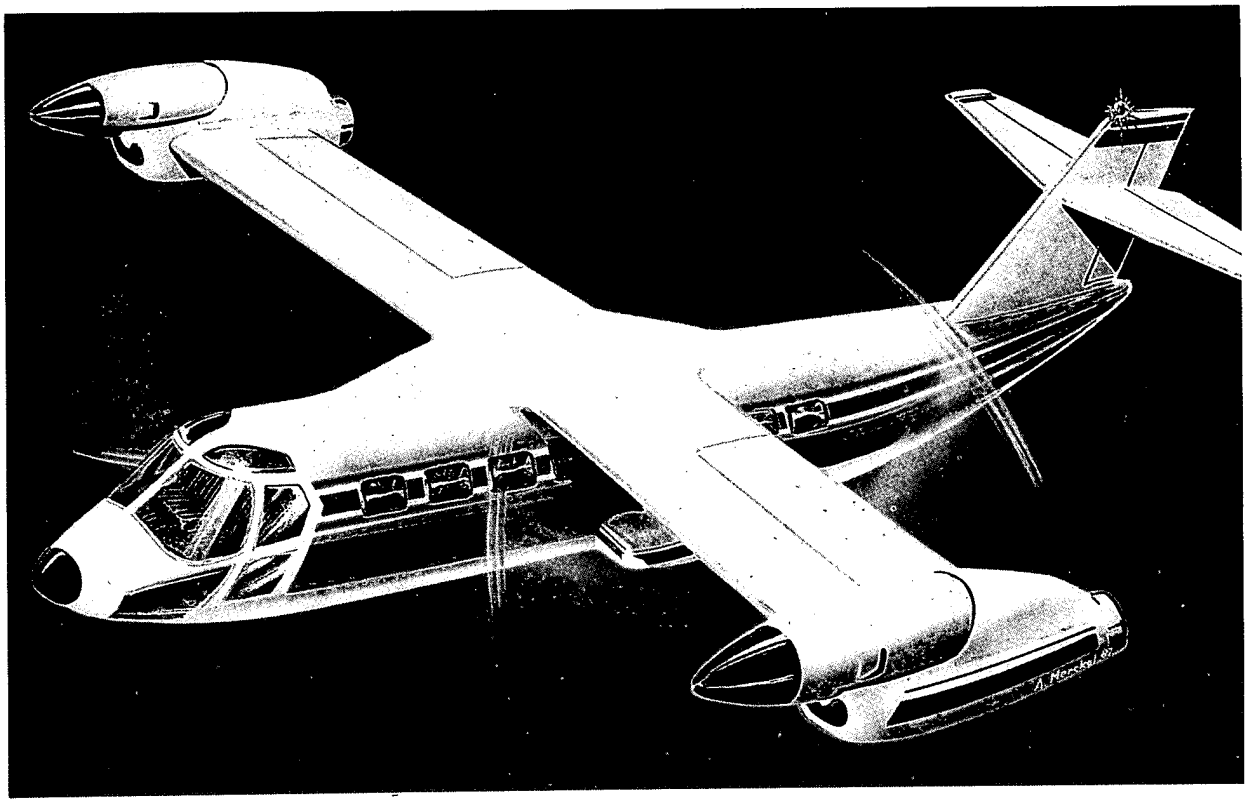
The Second International Conference and Exhibition on the Commercial Uses of Outer Space (Space Commerce 88) will be held on 21-25 February 1988 at the conference and exhibition center in Montreux, Switzerland, according to the Saclay MEETING Data Base and AIR & COSMOS (9 Sep). Further information can be obtained by contacting Mr. Michel A. Graber, organizing secretary, 2, rue de la Gare, P.O. Box 122, CH-1820 Montreux, Switzerland. Tel: 41 2 163 4848.

Sharon W. X6340

## WEST EUROPE: "EUROFAR" TILT-ROTOR AIRCRAFT

Aerospatiale officials writing in L'AERONAUTIQUE ET L'ASTRONAUTIQUE (fourth quarter, 87) have described the general characteristics of the planned European Future Advanced Rotorcraft, EUROFAR, currently under development by a West European consortium composed of France's Aerospatiale, Italy's Aeritalia and Agusta, FRG's MBB, UK's Westland, and Spain's Casa and funded under Eureka. The developers expect the debut of the tilt-rotor aircraft to have a significant impact on worldwide markets for both fixed-wing aircraft and helicopters because of its lower costs, better performance, and increased flexibility. The consortium hopes to be able to compete with a US tilt-rotor aircraft expected on the market around 1992.

The consortium's preliminary phase proposals have been approved by the European Council of Ministers (see PERSPECTIVES Vol. 2, No. 16 p 11). An initial phase (1987-90) calls for studies on technology, budget, environmental concerns, and marketing. Technical development, construction of demonstration models, and flight testing will be accomplished during a second phase, with development and certification of production models scheduled for the third phase.



Current studies are based on a 10-metric-ton-class aircraft with further studies planned to confirm this market niche. The EUROFAR design (see artist's conception above) calls for an aircraft fuselage with low-aspect-ratio, high wings, and tilting, low disk-load rotors approximately 10 meters in diameter mounted at the wing tips. The basic version must be able to transport 19 passengers a distance of 1000 km at an average speed of 580 km/h. Interior dimensions are compatible with possible future military applications.

The EUROFAR is expected to have a gross weight of 10,200 kg with a useful load of 4,010 kg. A rolling takeoff offers the potential advantages of increased useful load (up to 6,800 kg, for a maximum takeoff weight of 13,000 kg) or extended range (up to 6,000 km). By taking advantage of the relatively high-altitude (7,500 m) flight capability of the tilt-rotor, fuel consumption can be reduced by as much as 50 percent compared with helicopters. The designers believe the high engine power planned for the basic version will assure excellent performance both in conventional climb and while hovering out of ground effect (3,400 m, standard atmosphere). The flight envelope will combine the performance of a helicopter and a twin turboprop plane, retaining good flight characteristics should one engine fail. Aerospatiale studies predict that the initial purchase price will be about 15 percent more than that for a helicopter but that the cost will be totally amortized after approximately 10 years in service due to a 50 percent reduction in operating costs.

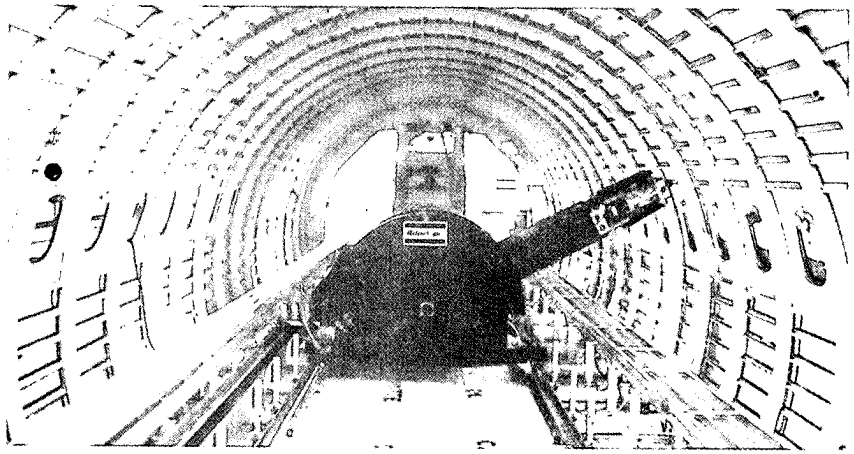
Martha W. X6285

## FRG: AUTOMATED RIVETING OF A-320 FUSELAGE

A third-generation automated riveting system is being used by Messerschmitt-Boelkow-Blohm at its Hamburg facility in construction of the new Airbus A-320, according to reports in the Frankfurt/Main daily, FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT (6 Oct) and the Paris weekly AIR & COSMOS (3 Oct). Like its first- and second-generation predecessors, the ARAS (Automatic Riveting Assembly System) is the product of joint development by MBB and Sweden's Atlas Copco.

The advanced system is set up for 12-axis operation, only 7 of which are currently being used, and the ARAS control system represents a significant advance beyond the first- and second-generation systems. A second installation is planned in preparation for the expected increase in the A-320 production rate.

The ARAS is designed to rivet the longitudinal seam in fully cylindrical assemblies, whereas earlier versions operated only on curved sections. The internal system is mounted on a track on the passenger compartment floor where a one-armed robot (see photo below) communicates with the external system. At the swiveling tip of the robot arm are two measuring devices. One determines the actual positions of the edge of the skin section and the stringers (longitudinal members for reinforcing the skin) as well as the horizontal positions of the upright frame segments. All the measured values are entered into the program, and any mispositioning of the robot is immediately corrected. This ensures a constant distance of the rivets from the edge of the material. The other robot-mounted measuring device ensures that the external system (the work cart) is in phase with the internal system (the robot). The new system can handle both Dural (driven) and HiLok (screw-like) rivets.



The robot arm also includes straight and slanted riveting dies, a system to supply HiLok rivets, and a screwing device with torque gauge. The external system holds two borers for aluminum and titanium, a gasket feeder, a rivet supplier (providing seven sizes of rivets), and a riveting hammer. Ten different riveting programs are available.

Sharon W. X6340

## ISRAEL: COMMUNICATIONS SATELLITE

Plans to build the Amos communications satellite were recently announced, according to HA'ARETZ (18 Oct). The satellite will serve Israel's expanding television, stationary and mobile telephone, and computer data transmission needs, which are expected to exhaust all available domestic communications modes within the next 15 years.

General Satellite Corporation (GSC), an Israeli-based private company headed by former minister Me'ir 'Amit and former diplomat Yehezqel Karmel, has been working for the past seven years together with the Israel Aircraft Industries and Ministry of Communications to design the satellite. Israel intends to launch two Amos satellites aboard the Ariane in 1992 and 1993 and place them in an equatorial orbit at 15° E longitude.

Approval for the satellite's orbital position has been granted by the International Telecommunications Union despite 42 objections submitted by various countries on technical (possible interference with nearby satellites) and political (Kuwait's expressed fear of Israeli "cultural expansionism") grounds. GSC is awaiting a financial commitment from the Israeli Government to begin production of the Amos.

Andrea S. X6517

## USSR: EXPERIMENTAL RADIO-OPTICAL RANGEFINDER

An experimental rangefinder has been built at the Moscow Institute of Geodesy, Aerial Photography, and Cartography for Engineers by adding an optical channel, consisting of a He-Ne laser (0.63 micrometers), to one of South Africa's "Tellurometr" series of radio-wavelength rangefinders, according to IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSEMKA, No. 2, 87. This experimental radio-optical rangefinder uses differences in refractive indices for centimeter radio wavelengths versus optical wavelengths to correct the ranges measured for the influence of moisture on the propagation velocities of the radio beam. This modification can be implemented with any model rangefinder in the "Tellurometr" series. The simultaneously measured moisture corrections are expected to reduce the ranging measurement error severalfold. A representative model is the CMW 20, which has a 9 mm carrier frequency, a range of 25 km, and an accuracy of 5 mm + 3 mm/km. The physical principles of radio-optical rangefinders are described in U.S. Pat. 250-218, No. 3437821 (1969), which is cited as the basis for this experimental modification. Field testing of the rangefinder is planned.

Normand H. X6327